REMARKS

By the present amendment, claims 8-9 and 14 -20 are pending in the application.

§112, ¶2

Claim 8 was rejected under 35 U.S.C. §112, second paragraph, as being indefinite.

In response to this rejection, claim 8 has been amended by the present amendment. In line 3 of claim 8, "the webs" has been change to --webs--. This provides an antecedent basis for "the web" appearing at line 9 of claim 8.

In view of the present amendment, it is respectfully requested that the rejection of claim 8 under 35 U.S.C. §112, second paragraph, be withdrawn.

§103

Claims 8-9 and 14-20 were rejected under 35 U.S.C. §103(a) as being unpatentable over U.S. Patent No. 6,754,992 to Byfield et al. in view of U.S. Patent No, 4,905,436 to Matsuo et al. and U.S. Patent No. 6,059,482 to Beauvoir.

These rejections are respectfully traversed.

It is noted from item (87) of the first page of the Byfield patent that U.S. Patent No. 6,754,992 to Byfield et al. is a counterpart to WO 01/36761 published on May 25, 2001.

The Present Invention

An important feature of the present invention is to provide a column and beam join structure capable of minimizing damages to the structure by plasticizing a split tee connection in advance of the column and beam so as to absorb the energy of an external force

by the split tee when the external force, such as an earth quake or strong wind, acts on the structure and thereby preventing the external force from damaging the column and beam.

The object of the present invention includes, as claimed in claims, a join structure wherein the flange of a split tee is connected to the flange of column by bolts and the web of the split tee is connected to the flange of the beam by bolts.

By use of the join structure of the present invention, and by specifying the strength of the material of the split tee and by inserting space keeping members between the flange of the split tee and the column, and by preferably providing the split tee with a shape in which the cross-sectional area of the flange of the split tee is partially reduced, the split tee of the present invention is plasticized and absorbs external force in advance of deformation of the column and beam of the structure.

Therefore, deformation of the column and beam of the structure can be minimized and the structure is kept safe.

Patentability

U.S. Patent No. 6,754,992 ("US '992") relates to a connector connecting column (1) and beam (2) and discloses a connector (3) having flange (4) and web (5) and each having plurality of slots (6) formed by an acute head (7) and a coextensive neck (8).

Further, as shown in Figs. 2, 3 and 7 of US '992, for example, a plurality of studs (11) having head (12) and shank (14) are fixed on the web or flange of the column and on the web of the beam by welding or bolting.

The acute head (7) of the slot (6) of the connector (3) of US '992 is inserted into the head (12) of the stud (11) fixed on the web of the column (1) and beam (2), and then is moved so that the shank (14) of the stud (11) is positioned at the neck (8) of the slot (6),

and as a result the web or flange of the connector is engaged with the shank of the stud fixed on the flange or web of the column and on the web of the beam.

That is, the column and beam of the structure of US '992 are connected by engaging the neck (8) of the connector (3) with the shank of the stud on the column and beam.

(3) As explained above, in the present invention, the web of the split tee is connected to the flange of the beam by bolting, while in US '992, as shown in Figs. 1, 2, 8-10, 12-13, 25, 27 and 28, the web of the connector (split tee) is connected to the web of the beam by engaging with studs and not by bolting.

Therefore, the joining form of the present invention is completely different than US '992.

According to the present invention, since the web of the split tee is connected to the flange of the beam, i.e., it is rigid connection, bending moment applied to the beam due to an external force is reliably transmitted to the split tee (web and flange).

In addition to the above connecting form of the present invention, since the connection is effected by bolting, transmission of the moment is very reliable.

Therefore, absorption of energy of an external force can be achieved by plasticizing the split tee of the present invention and the above mentioned effects are obtained.

On the other hand, in US '992, since the web of the connector (split tee) is connected to web of the beam it forms a rotation support, i.e., it is pin connection, bending moment applied to the beam due to an external force cannot be transmitted to the connector (split tee) in US '992.

In addition to the above connecting form of US '992, since the connection is effected by engaging the slot with stud and not by bolting, transmission of the moment cannot be sufficiently performed and the connection will be easily destroyed when a large external force acts on the structure.

Therefore, absorption of the energy of an external force cannot be achieved by plasticizing the split tee in US '992 and above mentioned effects of the present invention cannot be obtained by US '992.

Attached as Attachment 1 are Reference Figure (A) and (B) which explain (A) a pin connection of US '992 and (B) a rigid connection of the present invention. (Attachment 1).

In Reference Figure (A) explaining the pin connection of US '992, the beam is connected to the column by connecting the web of the connector (split tee) to the web of the beam and connecting flange of the connector to the web or the flange of the column, i.e., the connection of US '992 is made at one portion of the center of the web of the beam.

Therefore, the beam of US '992 can rotate in a vertical direction and bending moment applied to the beam cannot be transmitted to the connector (split tee). Therefore, the plasticization of the split tee cannot be performed.

On the other hand, in Reference Figure (B), explaining rigid connection of the present invention, the beam is connected to the column by connecting the web of the split tee to the flange of the beam and connecting flange of the split tee to the flange of the column, i.e., connection of the column and beam in the present invention is performed at both the upper and lower flange of the beam.

Therefore, the beam in the present invention cannot rotate and bending moment applied to the beam can be reliably transmitted to the split tee. Therefore, the plasticization of the split tee can be performed in the present invention.

Although in US '992, the connector (3) seems to have a flange and web wherein a cross-sectional area is partially reduced, these reductions are to form slots for inserting and engaging with studs and does not suggest forming a portion to be plasticized in advance of deformation of the column and beam.

Further, please note that the Fig. 30 of US '992 only show that the stud can be fixed to the web of the beam or column by a bolt and does not show that the connector (3) is bolted to the web of the beam or column.

As explained above, US '992 is different from the present invention in view of connection form and does not suggest a split tee having a shape wherein the cross-sectional area is partially reduced to plasticizing the split tee in advance of deformation of the column and beam.

(9) Regarding U.S. Patent No. 4,905, 436 ("US '436") and U.S. Patent No. 6,059,482 ("US '482") these references do not disclose or suggest the structure of the present invention.

US '436 relates to a bolted connector (split tee) for connecting beams and columns. The connector has a web having a partially reduced portion (thickness) and a flange having a tapered portion.

However, this connector of US '436 is made by die cast with a block of flange and has materially poor deformability.

Therefore, US '436 does not disclose or suggest the technical feature of the present invention that the flange of the split tee is plasticized prior to the other part of the split tee, the beam and the column.

Although the cross-sectional area of the flange of the connector of US '436 is partially reduced, the flange is merely tapered and does not have a cross-sectional shape promoting plasticization such as the present invention.

According to the present invention, in order to plasticize the flange of the split tee prior to other part thereof when tensile or compressive stress acts through the web, the cross-sectional area of the flange of the split tee, in this case the thickness of the flange, is partially reduced at least at a region corresponding to the extended direction of the web of the split tee.

Since the shape and the position where the partially reduced portion of the flange is provided are different from those of the present invention, US '436 does not disclose or suggest the present invention.

Further, although US '436 discloses yield strength of the connector, US '436 merely discloses the relationship of yield strength of steel material between the connector and the beams or the columns, and does not disclose limiting the yield of strength of steel material used for the flange of split tee within a specific range.

In the present invention, the limitations of upper limit of yield strength of the steel material used for the flange of the split tee is set to reduce the cost increase due to design change of the structure and/or the split tee.

In designing the structure of the construction, when yield strength of at least the flange of the split tee varies greatly, the dimension of the flange of the split tee and the

structure design have to be changed so that the effect of the energy absorption explained above can be obtained, and it causes cost increases. By limiting the variation of the yield strength of the steel material used for the split tee, within a specific range, cost increases due to the dimensional design change and structural design change can be reduced.

US '436 does not disclose or suggest that upper limit of the steel material used for at least the flange of the split tee are to be limited to a specific range.

US '482 relates to a column and beam join structure and discloses a structure where the column 2 and the beam 2 are joined by a connector 3 using bolts.

As shown in Fig. 9 of US '482, reinforcing plates 9 are inserted between the flange of the connector and the flange of the column.

Further, as shown in Figs. 1 and 2 of US '482, these reinforcing plates are provided to prevent the flange of the column from deforming by the tensile or compressive stress acting on the flange of the column when bending acts on the join portion.

Therefore, as described in column 4, line 46 to 50 of US '482, the reinforcing plates are welded to the surface of the flange of the column.

Further, the space between the flange of the column and the flange of the connector, which would serve as a deforming space for the flange of the split tee in the present invention, is not provided in US '482 at least at the region corresponding to the extended direction of the web of the split tee of the present invention.

Therefore, these reinforcing plates of US '482 cannot have a function to plasticize the flange of the split tee prior to other parts of the split tee, the column and the beam.

The reinforcing plates of US '482 are different from the space keeping members of the present invention and do not disclose or suggest the space keeping members of the present invention.

As explained above, none of US '992, US '436 and/or US '482 disclose or suggest the join structure of the present invention. Therefore, present invention cannot be derived from these documents even if they are combined.

Attached as Attachment 2 are drawings of Reference Figs. 1 and 2 explaining basic technical features of the column and beam join structure of the present invention with the split tee in comparison with the conventional structure without split tees.

Explanation of Reference Fig. 1 of Attachment 2 hereto, (a), (b), (c) (without split tee):

When a conventional join structure receives a large external force such as an earthquake, the conventional structure shown in Fig. 1 (a) swings and deforms as shown in Figs. 1(b) and 1(c) of Attachment 2.

At that time, the joining portion of the beam and the column is deformed by tension and compression and the beam is damaged.

Explanation of Reference Fig. 2 (a), (b) of Attachment 2 (with split tee of the present invention):

By providing the joining portion of the column and beam with the split tees, the split tees of the present invention receive the deformations due to tension and compression, and the deformation of the beam can be avoided.

Further, when tensile deformation and compressive deformation are received by the split tees of the present invention, these deformations act as a spring and plasticized the portion of the flange (or web) where a cross sectional area is partially reduced, and the

energy of the external force is absorbed and, as a result, deformation of the column and beam structure can be suppressed in the present invention.

It is therefore submitted that claims 8-9 and 14-20 are patentable over US '992, US '436 and/or US '482 alone or in combination.

CONCLUSION

It is submitted that in view of the present amendment and the forgoing remarks, the application is now in condition for allowance. It is therefore respectfully requested that the application, as amended, be allowed and passed for issue.

Respectfully submitted,

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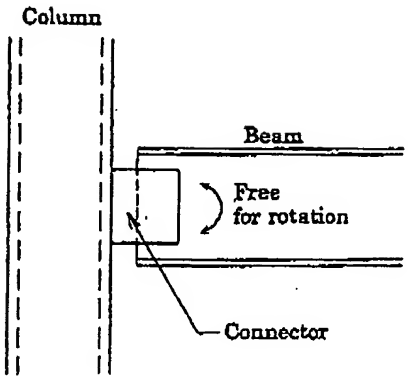
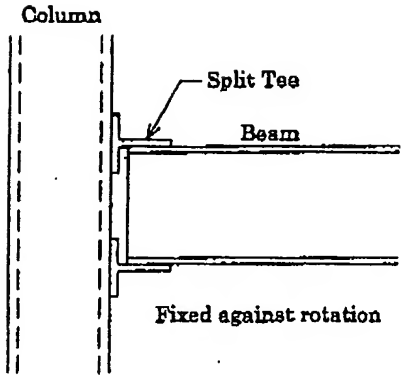
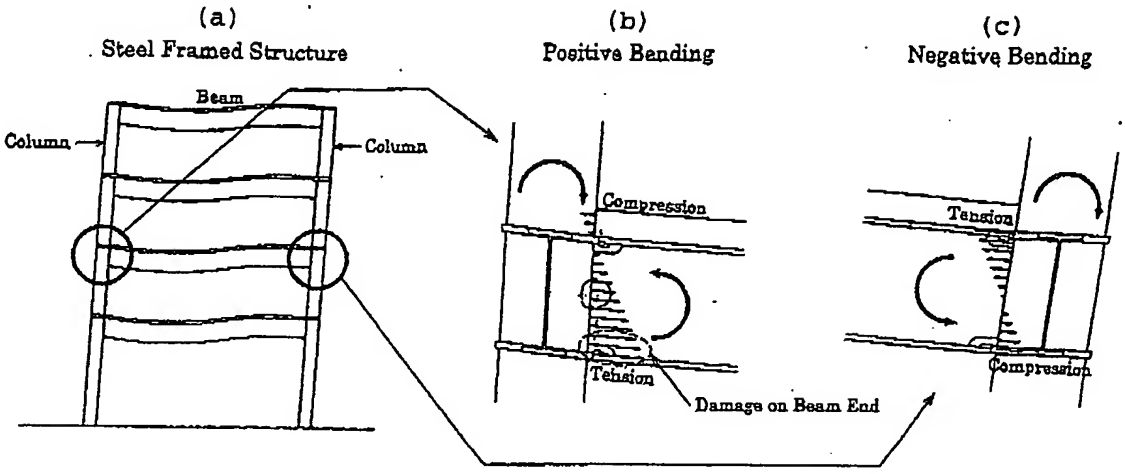
Attachment 1



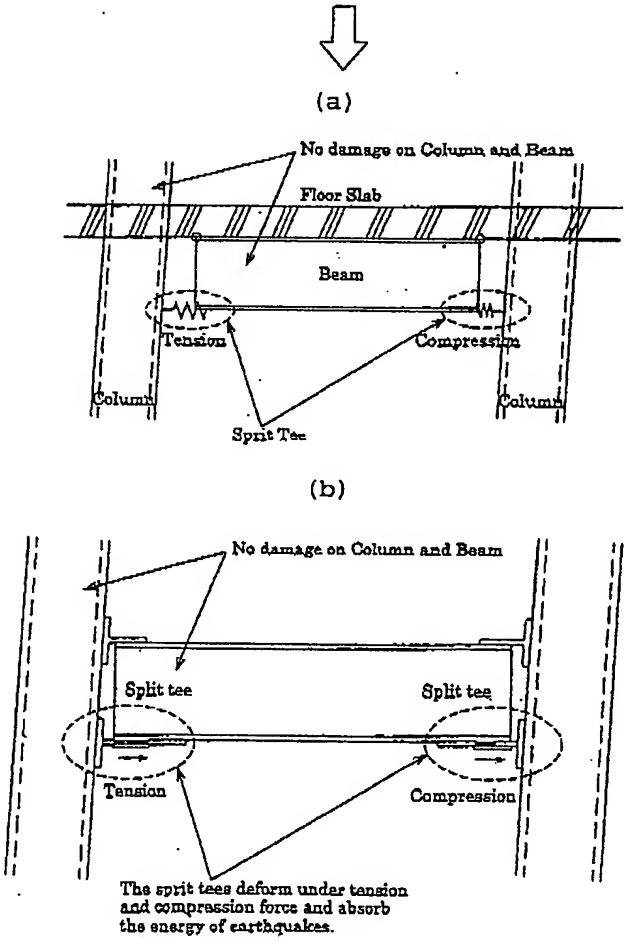
Reference Figure (A)
Pin Connection
(US '992)



Reference Figure (B)
Rigid Connection
(Present Invention)



Reference Fig.1 Strain in Beam-to-column Connection under Earthquake
(Typical Steel Structure : without Split Tees)



Reference Fig.2 Strain in Beam-to-column Connection under Earthquake
(with Split Tees)